

Nitrogen acquisition by plants and microorganisms in a temperate grassland

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Abstract

Nitrogen (N) limitation is common in most terrestrial ecosystems, often leading to strong competition between microorganisms and plants. The mechanisms of niche differentiation to reduce this competition remain unclear. Short-term ^{15}N experiments with NH_4^+ , NO_3^- , and glycine were conducted in July, August and September in a temperate grassland to evaluate the chemical, spatial and temporal niche differentiation by competition between plants and microorganisms for N. Microorganisms preferred NH_4^+ and NO_3^- , while plants preferred NO_3^- . Both plants and microorganisms acquired more N in August and September than in July. The soil depth had no significant effects on microbial uptake, but significantly affected plant N uptake. Plants acquired 67% of their N from the 0-5 cm soil layer and 33% from the 5-15 cm layer. The amount of N taken up by microorganisms was at least seven times than plants. Although microorganisms efficiently compete for N with plants, the competition is alleviated through chemical partitioning mainly in deeper soil layer. In the upper soil layer, neither chemical nor temporal niche separation is realized leading to strong competition between plants and microorganisms that modifies N dynamics in grasslands.

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